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# UTILIZATION RESEARCH and DEVELOPMENT

## FY 70 • Summary Report

U. S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service • April 1971

# Summary Report of

# UTILIZATION RESEARCH and DEVELOPMENT

FOREWORD

This report is prepared in response to a request by the Committee on Appropriations in its report to the Senate on the Agricultural and Farm Credit Administration Appropriation Bill, 1960 (Report No. 330), for an annual summary statement on utilization research and development activities conducted by the Agricultural Research Service. Previous reports have been submitted for fiscal years 1959 through 1969.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

# SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1970

## I AIM AND OPERATION OF UTILIZATION RESEARCH

Utilization research, aimed at expansion of agricultural markets and reduction of processing and distribution costs, can increase farm income, benefit domestic consumers, and contribute to U. S. programs of assistance to developing countries. Such research can help to bring into balance the supply of, and demand for, farm commodities. In pursuing its objectives, USDA's utilization research and development effort is directed to: (a) devising new food products that are attractive and economical, and fit the distribution requirements in worldwide market channels; (b) improving functional properties of the natural fibers, cotton, wool, and mohair, to better meet consumer needs; (c) developing more economic and more suitable processed feed products needed in the expansion of the poultry, dairy, and livestock industries; and (d) seeking broadened and profitable industrial uses for agricultural materials. Concurrent attention is given to such related functions as expansion of foreign markets for U. S. agricultural products, improved nutritional quality of food products, protection of food products from contamination by toxins and other health hazards, and reduction of pollution caused by agricultural processing wastes.

The Department's utilization research investigations in fiscal year 1970 were conducted primarily in Federal facilities in the United States, consisting of five divisions or regional research laboratories (located in New Orleans, La.; Albany, Calif.; Wyndmoor, Pa.; Peoria, Ill.; and Athens, Ga.) and twelve subsidiary field locations (in Beltsville, Md.; Washington, D. C.; Waltham, Mass.; Lexington, Ky.; East Grand Forks, Minn.; Olustee and Winter Haven, Fla.; Raleigh, N.C.; Weslaco, Tex.; Pasadena, Calif.; Honolulu, Hawaii; and Puyallup, Wash.). Additional research outside of these laboratories and field locations is conducted through contracts, grants, and memoranda of understanding with State Experiment Stations, universities, private research institutions, and industry. Other supporting research is conducted in foreign research institutions through funds generated by the P.L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session, as amended). The regional research laboratories, with the subsidiary field locations, constitute five of the nine divisions of the Marketing and Nutrition Research group of the Agricultural Research Service.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE

Continuing, positive emphasis is placed on disseminating the results of utilization research to interested segments of the agricultural industry. The following summary illustrates the uses made of various information media in F.Y. 1970:

- 81 patents granted
- 947 technical papers published
- 687 speeches, press releases, and appearances on radio and television
- 42 formal conferences with industrial and other organizations
- 9 exhibits for the public and technical groups
- 3,138 technical visitors to regional laboratory installations

### (A) Exhibit Materials

The following special exhibits were prepared and shown during F.Y. 1970 to inform the public and technical groups of USDA developments in food, fiber, and industrial products made from agricultural sources:

| Nature of Exhibit | Group Concerned |
|---|---|
| Unlocking food potential in cottonseed | American Oil Chemists' Society, Minneapolis, Minn. |
| do | First National Bank exhibit on "Future of Cotton," Levelland, Tex. |
| do | Cottonseed Processing Clinic, New Orleans, La. |
| do | Southern Agricultural Experiment Station Collaborators, New Orleans, La. |
| WURLANized wool | Northern California Headweavers, Monterey, Calif. |
| Cheese whey | Whey Utilization Conference, College Park, Md. |
| Potential new oilseed crops for the United States | Farm Progress Show, Buffalo, Ill. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (cnntd.)

(A) Exhibit Materials (contd.)

| Nature of Exhibit | Group Concerned |
|---|---|
| Development of waxy corn and high-amylose corn | Farm Progress Show, Buffalo, Ill. |
| Poultry processing research | Southeastern Poultry and Egg Association Convention, Atlanta, Ga. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| Conference on Treatment & Disposal of Wastes from Vegetable Processing (8/26/69) | USDA, La. Sweetpotato Comm., and La. State Univ. | 108 | New Orleans, La. |
| 1969 Conference on Citrus Chemistry and Utilization (10/17/69) | USDA | 118 | Winter Haven, Fla. |
| 18th Cottonseed Processing Clinic (2/16-17/70) | USDA, Miss. Valley Oilseed Processors Assn. | 108 | New Orleans, La. |
| 16th Annual Joint Conference of Cooperative Cottonseed-Soybean Mills (3/2-4/70) | USDA (ARS, Farmer Cooperative Service) | 172 | Brownsville, Tex. |
| Southern Experiment Station Collaborators Conference (3/16-17/70) | USDA and Southern Agr. Exp. Sta. collaborators | 49 | New Orleans, La. |
| 10th Cotton Utilization Research Conference (4/29-5/1/70) | USDA | 208 | New Orleans, La. |
| Lemon Products Technical Committee (4 times during year) | USDA and lemon industry | 60 | Pasadena, Calif. |
| Amer. Bakers Assn. Technical Liaison Comm. (10/8-10/69) | USDA, Amer. Bakers Assn. | 23 | Albany, Calif. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| Millers Natl. Federation Technical Liaison Comm. (11/4/69) | USDA, Millers Natl. Federation | 15 | Oakland, Calif. |
| 6th Natl. Conference on Wheat Utilization Research (11/2-7/69 | USDA, Great Plains Wheat, Inc., Millers Natl. Federation, Natl. Assn. of Wheat Growers, Western Wheat Associates, et al. | 120 | Oakland, Calif. |
| Annual Citrus Conference (12/2/69) | USDA and citrus industry | 70 | Pasadena, Calif. |
| Hops Research Subcommittee (1/23/70) | USDA, U.S. Brewers Assn. | 27 | Albany, Calif. |
| Wine Institute Viniculturial Research Committee (2/6/70) | USDA, Wine Institute | 35 | Albany, Calif. |
| Wine Institute Technical Advisory Committee (3 times during year) | USDA, Wine Institute | 200<br>200<br>400 | California<br>San Francisco<br>Fresno<br>San Francisco |
| Pollution Conference (2/26/70) | USDA, Western Expt. Sta. directors, U. of Calif. | 30 | Albany, Calif. |
| Western Expt. Sta. Collaborators Conference (4/6-8/70) | USDA, Pacific NW Water Lab., Natl. Canners Assn., NW Food Processing Assn. | 200 | Portland, Ore. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| Inst. of Amer. Poultry Industries Conference (5/21-22/70 | USDA, IAPI | 55 | Albany, Calif. |
| Fruit and Vegetable Processing Research Conference (5/21-22/70) | USDA and fruit and vegetable industry | 35 | Albany, Calif. |
| 19th Natl. Potato Utilization Conference (7/28-29/69) | USDA, Michigan State U., Mich. Potato Ind. Council, Mich. Crop Improvement Assn., United Fresh Fruit & Vegetable Assn. | 250 | Big Rapids, Mich. |
| 23rd Tobacco Chemists Res. Conference (10/22-24/69) | USDA and cigar industry | 297 | Philadelphia, Pa. |
| Eastern Expt. Sta. Collaborators Conference (10/28-29/69) | USDA | 100 | Wyndmoor, Pa. |
| Meat Packers and Processors Seminar (4/6-7/70) | USDA, Meat Packers Assn., Penna. St. U., Putgers U. | 70 | University Park, Pa. |
| Whey Utilization Conference (6/2-3/70) | USDA | 200 | College Park, Md. |
| Cigar Mfrs. Assn. of America Res. Subcomm. (3 times during year) | USDA, CMA | 27 | Wyndmoor, Pa. |
| NFPA Linseed Oil Technical Committee Meeting (6/22-23/70) | USDA, Natl. Flaxseed Processors Assn. | 23 | Peoria, Illinois |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| North Central Agr. Exp. Collaborators' Symposium on Pollution (3/23-24/70) | USDA, North Central AES collaborators | 94 | Peoria, Ill. |
| Soybean Utilization Research Conference (3/19/70) | USDA, Natl. Soybean Processors Assn. | 39 | Peoria, Ill. |
| Annual Corn Dry Milling Conf., ACMF Research Liaison Committee (6/16/70) | USDA, American Corn Millers Federation | 46 | Peoria, Ill. |
| North Central Agr. Exp. Sta. and Extension Directors Meeting (3/9-12/70) | USDA, North Central AES and Extension directors | 50 | Peoria, Ill. |
| UNIDO Expert Working Group Meeting on Soybean Protein Foods (11/17-21/69) | USDA, UN Industrial Development Organization | 55 | Peoria, Ill. |
| NSPA Collaborative Meeting on Amino Acid Analysis (4/7/70 | USDA, Natl. Soybean Processors Assn. | 10 | Peoria, Ill. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities

During FY 1970, continued technical, economic, and management assistance was given to going and proposed agricultural processing enterprises in rural communities and other areas employing rural labor. Such assistance embraced a broad range of subject categories and involved groups ranging from the smallest to multi-million-dollar enterprises. In these efforts, appropriate liaison has been maintained with other Federal and State agencies concerned with rural community development.

In the cotton industry, which provides millions of jobs on the farm and in rural communities, our contributions have included advice and consultation, in-plant and mill trials, and laboratory and mill tests for carrying out numerous textile operations. They include the processing and finishing of cotton goods; application of USDA-developed flame-retardant, durable-press, and weather-resistant finishes; development and use of product testing techniques; and fabrication and utilization of USDA-developed cotton processing machinery. A few examples of companies in the rural textile belt that have maintained close contact with USDA scientists include the following:

Georgia: Eagle and Phoenix Mills (Columbus); Sun Chemical Company (Columbus); William Carter Company (Barnesville); Canton Mills (Canton); and West Point-Pepperell (Dalton).

North Carolina: Burlington Industries (Greensboro); Fieldcrest Mills (Greensboro); Glen Raven Mills (Glen Raven); Kendall Mills (Charlotte); and Cone Mills (Greensboro).

South Carolina: Spring Mills (Lancaster); Crosrol Carding Developments (Greenville); and John D. Hollingsworth on Wheels (Greenville).

Examples of rural community development activities in other commodity areas include the following:

Assistance to Taormina Canning Co. (Donna, Tex.) in determining the calcium and magnesium content of water used in canning operations, and in recommending the optimum mix of "hard" and "soft" water necessary to produce a quality product.

Studies on the freeze-drying of lemon juice that permitted commercial production of an acceptable product by United Fruit and Food Corp. (San Carlos, Tex.).

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Assistance to Knapp-Sherrill Canning Co. (Donna, Tex.), including laboratory and in-plant tests, enabling that firm to eliminate the darkening of sliced canned beets and generally upgrade the quality of its product.

Laboratory tests on the freeze-drying of jalapena peppers that enabled Gebhardt Foods (San Antonio, Tex.) to make a freeze-dried product retaining the flavor, odor, and color of the natural peppers; these characteristics are normally downgraded by conventional dehydrating methods.

Progress in research on the fermentation of vegetables--both in developing new processes and in improving quality control techniques for conventional processes--that has benefited growers and processors in rural communities of Arizona, Arkansas, California, Louisiana, Michigan, Minnesota, North Carolina, Ohio, Texas, and Wisconsin.

Extensive tests on the application of the "dry" caustic peeling process to sweetpotatoes, in cooperation with Bush Brothers (Ville Platte, La.); this process is designed to reduce stream pollution by keeping most of the peeling material out of the plant effluent.

Assistance to Navajo Indian rug and blanket producers in the improvement of dyeing practices and lowering of costs. Assistance has been offered to the Navajos in improving other processing activities involving food, feed, and fiber.

Consultations with a grower and prospective processor of peppers in the San Joaquin Valley of California who is planning a plant for local processing of peppers.

Consultations with a grower and shipper of potatoes from DeLano, Kern County, Calif., an area of high unemployment, concerning the establishment of a potato processing plant. Pilot tests were made on the use of microwaves in blanching, to determine color retention in prepeeled potatoes.

Consultations with a processor in Medford, Ore., on the manufacture of drum-dried "instant" fruit flakes from cull and off-grade fruit, which in prior years has been a loss item. Envisioned is an expanded processing plant which will provide more employment opportunities throughout the year, as well as a good outlet for increased fruit production in southwest Oregon, an only partly developed area.

Initiation of studies to find profitable uses for rice and wheat straw and hulls, and other waste materials from farming, in order to reduce pollution caused by burning, dumping, and other presently-used methods of disposal.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

These waste materials occur in rural areas; and any industry set up to process them will help to increase employment in those areas. Contacts are being maintained with grower and processor groups.

Assistance to a sweetpotato cannery, the only industry in Tabor City, N. C., which was having difficulty meeting waste-discharge standards and was threatened with a shutdown. USDA's "dry" caustic method of peeling potatoes was explained. If suitable financing can be arranged, it is planned to set up this peeling method at the plant to serve as a demonstration model for other sweetpotato canning plants.

Consultation on a project sponsored by the Four Corners Commission to construct a dry bean processing plant in southwest Colorado, a largely undeveloped area. Plans were made for USDA assistance in feasibility studies to be made in FY 1971.

Advice to West Tacoma Newsprint (Steilacoom, Wash.) on the use of cereal-derived products in newsprint paper. The information helped the firm improve its paper quality so as to be more competitive.

Technical assistance to Inmont Corporation (Winthrop, Me.) concerning production and utilization of urethane plastics based on starch. This small company was investigating the possible manufacture of foams.

Technical information to the Alaska Agricultural Experiment Station (Palmer, Alaska) on the better utilization of present crops, and new crops adapted to the state.

Technical guidance to Baughman Oster, Inc. (Taylorville, Ill.) on drying and processing of corn. The Taylorville area is an important supplier to the corn processing industry, and corn quality is of major importance.

Technical information to Wyandot Popcorn Company (Marion, Ohio) on preparation of snack foods from white and yellow corn. Such information may be of real value in aiding the firm to become more economically competitive.

Information, economic evaluations, and technical guidance to a consultant of Hubbard, Ore., on utilization of agricultural residues in the Pacific Northwest. Pollution control is urgently needed there, and the burning of many of the crop residues is now prohibited.

Detailed economic and processing information to practically all of the state wheat commissions, millers federations, and associations of wheat growers on the conversion of wheat and other cereal grains to ethyl alcohol and by-product feeds, and the possible utilization of the alcohol as a motor fuel additive.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Detailed information and guidance to the Illinois Soya Company (Urbana, Ill.) on production of oil from crambe seed. This small plant had been idle for several years.

Assistance to Pacific Grain Company (Farmer City, Ill.) in its program to produce and market waxy corn and high-amylose corn. Waxy corn was grown under contract in Illinois and Indiana, on several thousand acres, for an export cash market. The firm also was assisted in its program to develop new crops, including crambe and other oilseed crops.

Assistance to Ketchikan Pulp Company (Ketchikan, Alaska) in its program to produce quality dissolving pulp from Alaskan-grown wood. The firm was visited in the course of this contact.

Visits and assistance to VWR United Corporation (Seattle, Wash.) in connection with its program to convert wheat flour into gluten and wheat starch and to develop industrial markets for the starch. A new plant to be located in Spokane, has been announced by this firm.

Presentations before regional-action panels for Illinois, Michigan, Minnesota, Wisconsin, and the Great Lakes area, on agricultural utilization research developments that might be used in these regions.

Cooperation with National Cottonseed Products Association (Memphis, Tenn.) in promoting sunflowers as a crop in the South.

Cooperative work with Fairfield Farms (Lake City, Fla.) on alleviating the mortality factor in cattle feedlots.

Cooperation with Georgia Peanut Shellers Association in finding uses for peanut hulls. These are presently burned, causing excessive air pollution; some shelling plants may be forced to close on this account.

Information on improved, quick-cooking vegetable products by USDA's explosion-puff dehydration process (Gilroy and Oxnard, Calif.).

Information on USDA's high-flavor maple sirup process which has led to its commercial adoption (Stamford, N. Y.).

Advice to orchardmen and processors on new systems for mechnical harvesting of cherries and apples (Michigan, New York, Pennsylvania).

Assistance to new plant for making fruit juice essence and concentrate (Grandview, Wash.).

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Advice on adoption of new USDA ultraviolet irradiation process for preserving cider (Yucaipa, Calif.).

Advice on commercial production of air-dried mushroom pieces by USDA process (Kennett Square, Pa.).

Advice on USDA shearling research developments to aid sheep raisers and rural industry (Quakertown, Pa. and Boone, Iowa).

Advice on new method of purifying fatty acids, with a potential for increased utilization of surplus animal fat (Cedar Knolls, N. J.).

## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative work with other groups is undertaken to develop new products, improve existing products and processes, devise economic processes for product manufacture, evaluate products and processes, and explore new outlets for agricultural products. These cooperative efforts contribute to early commercialization and broadened usage. Examples of cooperative research and development conducted in F.Y. 1970 are as follows:

| Activity | Cooperators with USDA |
|---|---|
| Improved cotton fabrics for men's and boys' trousers, dress suits, and durable press apparel | Cotton Producers Institute |
| New chemical systems for flame-resistant cotton | Army Natick Laboratories |
| Development of efficient, low-cost flame-retardant treatments for cotton batting | Natl. Cotton Batting Inst., Textile Fibers & Byproducts Assn., Foundation for Cotton Research & Education, Natl. Cottonseed Products Assn., Natl. Assn. of Bedding Mfrs. |
| Textile and clothing research | University of Tennessee |
| Improved outdoor cotton fabrics | Canvas Products Assn., Cotton Producers Inst. |
| Chemical composition and characteristics of cottonseed protein | Foundation for Cotton Research & Education, Natl. Cottonseed Products Assn., Cotton Producers Inst. |
| Fermentative processing of cucumbers and other vegetables | Pickle Packers International, N.C. and Mich. Agr. Exp. Stations |
| Foam-mat dehydration process for manufacture of citrus juice powders | Florida Citrus Commission |
| Chemical and physical characteristics of agricultural crops and their products | N. C. Agr. Exp. Station |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Sugar production from sweet sorghum | Louisiana State University |
| Wet processing of alfalfa | Batley-Janss Enterprises and Dixon Driers, both of Dixon, Calif. |
| Dry caustic peeling of fruits to reduce pollution | Natl. Canners Assn., Berkeley, Calif. |
| Processing rice straw for animal feed | Butte County (Calif.) Rice Growers Assn. |
| Plant-scale tests of improved WURLAN wool process | Columbiaknit, Inc., Portland, Ore. |
| Development of heat-and-serve sourdough bakery products | Larraburu Bros., San Francisco, Calif. |
| Lysine fortification of bulgur | Bulgur Associates, Washington, D. C. |
| Stabilization of flour blend A | Millers National Federation |
| Market testing of frozen, quick-cooking beans | Oxnard Frozen Foods Coop. and China Doll, Inc. |
| Improved bean products | Lima Bean Advisory Board and California Dry Bean Advisory Board |
| Preservation of high-moisture dates | Calif. Date Administrative Committee |
| Control of microbiological contamination of dried fruits and nuts | Dried Fruit & Tree Nut Assn. of Calif. |
| Processing of mechanically-harvested dates | Fresno (Calif.) State College |
| Evaluation of reverse osmosis in a potato processing plant to concentrate processing waters | J. R. Simplot Co. |
| Technological and market development of new dairy foods | Dairy Development, Inc. (organization of Northeastern dairy coops) |

III COOPERATIVE RESEARCH WITH OTHER OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Dewaxing prior to lye peeling of tomatoes | Safeway Stores; South Valley Mfg. Co.; Martinez Food Co. |
| Market development of new lamb products | Penna State U.; Horn & Hardart Foods; Stouffer Div. of Linton Industries |
| Tenderness of meat in relation to cooking method | Cornell University |
| Standardization of methods for detection and enumeration of microorganisms in food | Int. Comm. on Microbiological Specifications for Foods |
| Production of phenylstearic acids and derivatives | Armour & Company |
| Evaluation of comminuted collagen from split cattle hides as a component of human and pet foods | Devro Div. of Johnson & Johnson: Armour & Co.; Quaker Oats Co.; General Mills |
| Use of long-carbon-chain fatty compounds ("deriphats") to impart washability and dry-cleanability to leather and shearlings | General Mills |
| Neutral constituents in cigar smoke from different types of cigars | Cigar Mfrs. Assn. of America |
| Analysis of corn samples to guide geneticists in developing high-amylose corn for industrial use | Bear Hybrid Corn Co. |
| Utilization of linseed oil in protective coatings | Natl. Flaxseed Processors Assn. |
| Development of superior plant sources of vegetable oils of high erucic acid content | Oregon Agr. Exp. Station |
| Development and production of cationic cereal products | Dow Chemical Co. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Separation of chopped T. vogelii plants into leaf and stem fractions to improve rotenoid yield | Bauer Brothers Co. |
| Studies on the involvement of Fusarium tricinctum in fescue foot | University of Wisconsin |
| Utilization of linseed oil for concrete protection | Natl. Flaxseed Processors Assn.; several State highway departments |
| Production of microbial gums from cereal grains | Kelco Co.; General Mills |
| Integration of research programs | University of Georgia Botany Dept. |
| Evaluation of roast beef quality | University of Georgia Home Economics Dept. |
| Evaluation of effect of "alar" on peach harvest uniformity | Georgia Agr. Exp. Station |
| Evaluation of southeastern-grown Babygold clingstone peaches for processing | South Carolina Extension Service; Gerber Baby Food Co.; J. B. Robinson Co. |
| Characterization of poultry processing plant effluents | Poultry processing plants |
| Processing of soybeans with available cottonseed processing equipment | Georgia Agr. Exp. Station; Louisville (Ga.) Fertilizer & Gin Co. |
| Evaluation of sunflower seed and oil | Stevens Industries; Farmers & Ginners Cotton Oil Co., Minnesota Linseed Oil Co., various State Experiment Stations |
| Relation between properties of southern forages and animal response | Southern Regional Technical Committee on Forages (S-45) |

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

### (A) Planning and Advisory Activities

The USDA program of utilization research on farm commodities is the product of extensive planning that is continually updated. Its administration is the direct responsibility of a deputy administrator of the Agricultural Research Service, his supporting staff, and the directors of the five regional research laboratories. A Program Development Staff of ARS, composed of economic specialists, assists this administrative group in evaluating the appropriateness and commercial feasibility of proposed and existing utilization research projects. Information and guidance are sought from various other sources both within and outside the Department. Among the advisory groups that oversee the program, the following may be mentioned:

National Program of Research for Agriculture. Pursuant to a directive from the Senate Committee on Appropriations (Senate Report No. 156), in 1965-66 a joint study was made by representatives of USDA, State Agricultural Experiment Stations, and the land-grant colleges, to look into all areas of agricultural research conducted by the Department and the State Experiment Stations. A report of the study, entitled "A National Program of Research for Agriculture" and essentially completed in F. Y. 1966, includes an appraisal of the current status of agricultural research and definition of future agricultural needs.

To implement the recommendations of the National Program, 32 task forces were established, of which the following are concerned with utilization research: Cotton; soybeans; peanuts; corn and grain sorghum; wheat and other small grains; rice; fruits; vegetables; sugar crops; tobacco; minor oilseeds as well as miscellaneous and new crops; forestry; forage, range, and pasture; beef; dairy; swine; poultry; sheep and other animals; food and nutrition; food safety; pollution in relation to agriculture; and foreign aid and market development.

Agricultural Research Policy Advisory Committee. This committee, established in 1969, has for co-chairmen USDA's Director of Science and Education and the president of a land-grant college or university. USDA representatives include the administrators of the Agricultural Research Service, Cooperative State Research Service, Economic Research Service, Farmer Cooperative Service, Federal Extension Service, and Statistical Reporting Service, and the deputy chief for research of the Forest Service. State representatives include an Agricultural Experiment Station director from each of four agricultural regions, and representatives of the National Association of State Universities and Land-Grant Colleges, the Association of State College and University Forestry Research Organizations, and the Experiment Station Committee on Organization and Policy.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(A) Planning and Advisory Activities (contd.)

The objectives of this committee are to assist in solving local, regional, and national problems affecting agriculture, forestry, other renewable natural resources, and rural life; in providing scientific expertise to local, state, and Federal government agencies, private organizations, and individuals; in providing scientific competence for teaching and to make available increased research opportunities for graduate students, in providing a continuing flow of new knowledge essential to the solution of current and future problems; and in providing scientific expertise and research in support of programs that relate to foreign nations.

National Agricultural Research Advisory Committee. An 11-member advisory committee, with broad national interests in all phases of agriculture, evaluates the Department's entire research program and offers suggestions, particularly on policy matters, for changes in the program. Four of the committee members are representatives of producers or producer organizations.

Agricultural Associations and Industry Groups. Advice is sought from, and information is exchanged with, all segments of the agricultural industry, including growers, shippers, processors, and distributors, concerning the many problems involved in the profitable development of new or improved uses for agricultural commodities.

Consumer Interests. Information on consumer desires for new or improved products, and on evaluation of such products, is sought through contacts with consumer groups of national and regional scope. Other USDA groups--the Economic Research Service, the Federal Extension Service, and the ARS marketing and consumer use research groups--provide advice on consumer needs and market trends.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection

The utilization research program is continually reviewed to assess its fruitfulness. Investigations that have reached their objectives are discontinued. Investigations that have passed the point of maximum returns, or are otherwise relatively unproductive, also are discontinued so that the resources may be more effectively applied to new programs. More promising investigations are established or intensified, either by reduction of effort on projects of lesser importance or by use of such new resources as may become available. Examples of the redirection of research effort are shown below:

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Cereal and Forage Crops** | |
| Selected aspects of studies on subcellular structure of corn genotypes | Microscopy and histochemistry of grain sorghum |
| Isolation and purification of aflatoxin | Biopolymers in activated sludge |
| Dialdehyde starch-protein glue for Southern pine plywood | Dialdehyde starch-protein glue for birch hardwood plywood |
| Systems for processing and fractionating grain sorghum | Conversion of corn and grain sorghum to nutritious food products |
| Study of oxidation-reduction enzymes in wheat flour | Taxonomy of sour-dough bacteria |
| Assay for unidentified growth factors in alfalfa | Improved feeds from agricultural wastes |
| **Cotton, Wool, and Other Fibers** | |
| Correlation of abrasion tests with service wear of durable-press cotton | Methods of abrasion evaluation which best correlate with fabric service wear |
| Study of cellulose etherification mechanisms to expand cotton utilization | Mechanisms and kinetics of reactions of cotton with N-methylolated compounds |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Cotton, Wool, and Other Fibers (contd.)** | |
| Improved durable-press cotton fabrics by use of wet-fixation techniques | Durable links to cotton cellulose from highly reactive agents |
| Kinetics of cotton-heterocyclic reactions and evaluation of products | Reactions of cotton with heterocyclics in nonaqueous media |
| Durably-creased cotton fabrics with improved physical properties | Nonaqueous treatments to improve fabrics properties and reduce water pollution |
| Controlled recrystallization of amorphous cotton prior to crosslinking | Orientation and crosslinking of non-crystalline inclusion complexes of cotton |
| Imparting flame and rot resistance to cotton | New chemical systems to impart improved flame resistance and safety to cotton |
| Structural composition of selected chemically modified and crosslinked cotton | Structure of reaction products from N-methylolated reagents under cotton crosslinking conditions |
| Effect of reaction conditions on crosslinking reactions in cotton | Structures of unmodified and crosslinked cotton and relation to performance |
| Substitution and crosslinking of cotton by non-nitrogenous etherifying agents | Improved durable-press cotton by substitution at cellulosic carbon atoms |
| Fog, vapor, or aerosol systems for cotton finishing | Safer cotton textiles through vapor-phase reactions to impart flame retardance |
| **Fruits and Vegetables** | |
| Improved natural celery flavor from fresh celery sources | Composition of essential oils in citrus products |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Fruits and Vegetables (contd.)** | |
| Proteins of the white potato | Recovery of useful materials from potato wastes |
| Color development during frying of potato chips and French fries | Characterization and improved determination of potato glycoalkaloids |
| Improved desert grapefruit products | Processing raisins from mechanically-harvested grapes |
| Study of fruit pigments for improving color of processed products | Natural product antimicrobials for preserving dried fruit |
| Effects of processing variables on properties of dehydrated products | Reducing wastes from commercial fruit peeling operations |
| **Oilseeds** | |
| Variables affecting film-forming properties of linseed oil emulsions | Morphology of linseed oil coatings |
| Homogeneous catalysts for selective hydrogenation of soybean oil | Chemical modification of linseed and soybean oils with organometallic compounds |
| Chemical, biochemical, and physicochemical properties of cottonseed protein | Relation of chemical characteristics to functional properties of cottonseed protein products |
| Aroma and flavor of roasted peanuts and peanut products | Effect of variety and history on chemical components of processed peanut aromas |
| Methods of detecting molds and mycotoxins in peanuts for quality control in peanut processing plants | Inactivation chemistry and origin of mycotoxins produced in peanuts by mold |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Oilseeds (contd.)** | |
| Elimination of aflatoxins from contaminated cottonseed and cottonseed products | Pilot-plant removal or destruction of aflatoxins in cottonseed products |
| Elimination of aflatoxins from contaminated peanuts and peanut products | Pilot-plant removal or destruction of aflatoxins in peanuts and peanut meals |
| **New and Special Plants** | |
| Evaluation of handling techniques for kenaf at various stages of maturity in preparation of chemical pulps | Storage of kenaf and variability of methods for its processing as a pulp and papermaking raw material |
| Unidentified components of pine oleoresin and rosin | Condensation-type polymers from ponderosa pine stumpwood oleoresin |
| Diamines and diisocyanates from rosin derivatives | Polyisocyanates from resin acids in urethane condensation polymers |
| Polyurethanes derived from rosin, resin acids, and pine gum | Polyurethane foams from glycols derived from rosin, resin acids, and pine gum |
| Basic studies of chemical composition of cigarette smoke condensate (decreased effort) | Modification of composition and improved filtration of cigarette smoke |
| **Poultry, Dairy, and Other Animal Products** | |
| Physical stability of sterilized milk | Enrichment of milk with iron |
| Pilot-plant studies of low-fat cheese | Concentration of dairy products, especially cheese whey, by reverse osmosis |
| Chemistry of meat smoking | Compounds formed in curing meat; possibility of nitrosamine formation |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Poultry, Dairy, and Other Animal Products (contd.)** | |
| Introduction of new reactive groups into hide protein to facilitate tanning | Graft polymerization in hides of vinyl monomers |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(C) Status of Research Projects

Summary of Actions

| | Active at beginning FY 1970 | Initiated or revised | Terminated | Active at end FY 1970 |
|---|---|---|---|---|
| Domestic | 447 | 98 | 134* | 411** |
| Foreign (P.L. 480) | 92 | 5 | 44 | 53 |
| Total | 539 | 103 | 178 | 464 |

* 129 projects were terminated because the objectives had been wholly or substantially achieved; the remaining 5 projects were terminated because the results were unpromising, or because the work was superseded by research of higher priority.

** Includes 58 domestic contract and grant projects, 2 projects wholly or partly supported by industry (fellowships and direct financial support), and 1 project supported by funds transferred from another Federal agency.

Commodity Classification of New Research Projects Undertaken in FY 1970

| | Domestic | Foreign | Total |
|---|---|---|---|
| Cereal and forage crops | 19 | 1 | 20 |
| Cotton, wool, and other fibers | 18 | 1 | 19 |
| Fruits and vegetables | 11 | 2 | 13 |
| Oilseeds | 17 | 1 | 18 |
| New and special plants | 19 | 0 | 19 |
| Poultry, dairy, and other animal products | 14 | 0 | 14 |
| Total | 98 | 5 | 103 |

(D) New Research Initiated with Appropriation Increases in FY 1970

Development of processing technology for new Southeastern peach varieties ($92,500).

Identity and chemical-physical nature of colorants in refined cane sugar ($50,000).

## V CURRENT UTILIZATION RESEARCH PROGRAM

USDA's utilization research program is directed to finding new or improved uses and improved processing methods for agricultural commodities through basic, applied, and development research. As previously indicated, it is subject to continual review and appraisal at all levels, from Work Units (limited assignments involving up to several man-years of effort for periods of not more than five years) up through broad general areas of activity. Within the general framework of new uses, and in response to recommendations of advisory groups, special attention in recent years has been given to safety of food and feed products as concerns natural toxins, chemical additives, and inadvertent contaminants; to development of products specifically suited to export markets; and to development of modifications in the processing of agricultural commodities that will minimize air and water pollution problems.

The following listing of subject fields will illustrate the general nature of the current program. These are fairly broad areas, some of which have been mentioned in previous reports, while others are new.

### Cereal and Forage Crops

Emphasis is placed on development of new uses for corn and wheat, with concurrent effort on rice, barley, oats, sorghum, and alfalfa and other legume and grass forages.

New and improved food products--Improved physical properties of wheat doughs; improved quality of frozen unbaked bread; new and improved rice products with better nutritive value and other quality factors; improved maturation of wheat flours; new and improved high protein wheat foods for export; improved baking performance of blended spring and winter wheats.

Microbiology of cereal flours; milling artificially dried corn to improve yield, quality, and size of grits; dry milling of high-lysine corn; milling and fractionation methods for production of wheat fractions of improved yield and quality for foods; conversion of starch to sugars and sirups; development of new low-cost corn foods for institutional use; development of grain sorghum endosperm products and their use in convenience foods; rennin from microbial sources.

Improved feeds--Improving the nutritive value of alfalfa, wheat, small grains and mill fractions for ruminant, poultry, and swine feeds; dense, stable, concentrated low-fiber forage products for export; separate recovery of protein and other feed nutrients from forages; improvement of feed values of agricultural wastes.

Fusarium toxins and other mycotoxins as causes of toxicity in tall fescue; aflatoxin in grain.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

New industrial uses--Starch graft copolymers as flocculating, viscosity-improver, and adhesive agents; starch xanthides as wet-strength agents in paper; cationic starches and flours for coating and sizing paper; development of starch-derived chemicals for plastics and coatings; reinforcement of rubber with starch by latex masterbatching; new classes of high-amylose corn starch for industrial use; development of dialdehyde starch-protein plywood glue; lower cost process for xanthan production; production of spores to control Japanese beetle infestations; discovery and evaluation of microbial polysacolloids for industrial use; microbial production of L-asparaginase, a therapeutic factor active against leukemias; development of biodegradable surfactants and detergent builders from starch; fermentative utilization of cereal grain processing wastes to reduce pollution; new products from rice hulls; development of new and improved feeds and rations from Southeastern grasses and grains.

## Cotton, Wool, and Other Fibers

Cotton chemical processing--Improved durable-press cotton fabrics; cotton products with improved soil resistance, launderability, and drying characteristics; improved mildew-, rot-, water-, weather-, and air pollution-resistant cotton products; development of low-cost flame-retardant cotton batting; flame-retardant cotton products with other desirable properties; reduction of stream and air pollution resulting from the processing of cotton textile materials.

Cotton mechanical processing--Improved spinning efficiency and yarn quality; improved cotton prespinning processes; aerodynamic-electrostatic-ultrasonic spinning system; improved utilization of discount cotton.

Improved wool and mohair products--Improved wool and mohair fabrics requiring minimum upkeep; improved fabrics from wool and mohair blends.

Textiles and clothing--Modification of laundering procedures and equipment to improve wear life of cotton garments; better fitting consumer apparel; prevention of microbiological contamination of textiles during laundering.

## Fruits and Vegetables

Emphasis is given to development of convenience-in-use fruit and vegetable products, and processing equipment for their economic manufacture. The work includes fundamental investiations of factors affecting color, texture, and flavor.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Fruits and Vegetables (contd.)

Citrus and subtropical fruits--Citrus products with improved flavor, color, and stability; sweetening agents from citrus flavonoids; improved stability and flavor of nonfrozen subtropical fruit juice concentrates and purees; freeze-dried citrus and subtropical fruit products; foam-mat dried orange products; comminuted citrus products; reduction of particulate matter in stack gases from citrus feed driers, to reduce air pollution.

Deciduous fruits and berries--Evaluation of processing characteristics of Pacific Northwest berries and other fruit; dried fruit and tree nut products for foreign markets; improved processes for wine production; control of pollution and conversion of waste products of fruit processing; reduced microbial contamination in processing of fruits; changes in pesticide residues during processing of fruits; natural product antimicrobials for dried fruit preservation.

Improved procedures for peeling apples and other methods of reducing processing losses from mechanically-harvested apples and cherries; evaluation of processing characteristics of new Eastern pear varieties; improved piece-form and powdered dehydrated fruit products; development of processing technology for new Southeastern peach varieties.

Vegetables--Development of controlled food fermentation processes; modified and enriched products from sweetpotato puree and flakes; dehydrated celery products with improved flavor; improved tomato and other vegetable products.

Frozen vegetables with improved texture; dehydrated vegetables of improved quality and stability for export markets; evaluation of processing characteristics of Pacific Northwest vegetables; control of consistency of tomato products; convenience foods from dry beans and peas; canned low-acid foods of improved quality and safety; control of pollution and conversion of waste products from the processing of potatoes and other vegetables; reduced microbial contamination in vegetable processing; changes in pesticide residues during vegetable processing.

Characterization and improved determination of potato glycoalkaloids; rapidly rehydratable, quick-cooking dehydrated vegetable products in piece form; effect of source factors on texture, color, flavor, and composition of processed potato products; recovery of proteins and other useful materials from potato wastes.

Oilseeds

Food uses--Elimination of the physiological effects of cyclopropenes to safeguard foods containing cottonseed oil; development of processes for making new type food-grade esters from cottonseed oil fatty acids;

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Oilseeds (contd.)

preparation of confectionery fats and other edible, sharp-melting fats from cottonseed oil; edible high-protein cottonseed products; detection, estimation, prevention, and elimination of aflatoxins in cottonseed and peanuts; elimination of Salmonella in cottonseed meal products; new and improved low-fat peanut products; high-protein peanut products for export markets; roasted peanut products of improved flavor and stability; improved thermal and oxidative stability of safflower oil.

Development of high-protein foods for export markets from full-fat soy flours; improvedflavor stability of soybean oil through selective hydrogenation of linolenate esters with non-nickel catalysts; development of processes for the removal of objectionable flavors and other undesirable factors from soy flours; lower cost process for refining soybean oil with reduction of water pollution.

Evaluation of sunflower oil from varieties grown in different locations for use in edible oil, margarine, and shortening; evaluation of defatted sunflower meal for use in high-protein foods.

Feed uses--Improving protein feed supplements from erucic acid oilseeds; evaluation of defatted sunflower meal for use in poultry, swine, and ruminant feeds; improved animal feedstuffs from safflower and other western oilseeds; production of safe-to-handle nutritious feedstuffs from castor bean meal.

Industrial uses--Properties and utilization of amides from cottonseed oil; linseed oil for curing and protecting concrete; improved durability of linseed oil emulsion paints; development of high-performance jet lubricants from linseed and soybean oils; development of nylon-type polyamides from vegetable oils; allyl resins from soybean, linseed, and high-erucic oils for coatings and plastics; special-purpose plasticizers from soybean, linseed, and high-erucic oils; utilization of Western seed oils in industrial products.

New and Special Plants

Investigations to develop new and more economic uses for special domestic plants and their products; and to develop compositional data on plants from world-wide sources, to find alternate crops to fill needs not now met by domestic sources.

Naval stores products--Condensation polymers from derivatives of pine gum rosin; new or improved derivatives from rosin for use in adhesives and concrete.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

New and Special Plants (contd.)

Tobacco--Studies of physiologically-active compounds in tobacco leaf and smoke; determination of products formed on burning leaf tobacco; effect of added chemicals on smoke composition; development of rapid bioassay methods and measurement of tobacco smoke condensate by these methods.

New alternate crops--Search for new plant sources of industrial vegetable oils among 10,000 samples from worldwide collections; development of technology for production of marketable rotenoid products from the legume Tephrosia vogelii; development of papermaking pulp from kenaf by the sulfate process; tumor-inhibiting substances from plant materials.

Other crops--Studies of cane sugar refining to obtain higher yields and a purer product; development of methods for purifying sweet sorghum juices that will permit practical recovery of their sugar content; improved systems for collecting maple sap and converting it to sirup; development of improved products from maple sirup.

Poultry, Dairy, and Other Animal Products

Development of better and more economical food products from poultry, eggs, milk, and meat, and development of new outlets for fats, hides, and other animal byproducts.

Poultry and eggs--Low-cost, uniform aging of poultry for freezing, process modifications to improve and extend the variety of poultry products; elimination of processing damage to egg products; control of Salmonella in poultry meat, liquid eggs, and dried eggs; processes to improve the aroma and flavor of cooked poultry; control of microbial contamination by clostridia and staphylococci in processed poultry products; new and improved methods for recovery and utilization of inedible wastes and byproducts from poultry processing plants.

Dairy products--Enrichment of dairy products with iron; process modifications to provide dry whole milk for beverage use; characterization and utilization of flavor potential of milk fat; improving properties of sterile concentrated milk; studies to determine causes and means of control of allergic responses to milk; control of pathogenic microbial contamination in dairy products; development of new foods containing cheese whey; improved efficiency and lower cost of whey disposal.

Animal fats--New biodegradable detergents and other surface-active agents from animal fats; replacement of phosphates in detergent compositions; improved animal fat derivatives for lubricant compositions; reactive chemical intermediates from fatty acids for industrial use; improvement in color and odor stability of commercial fatty acids; flame-resistant polymers for the plastics industry.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Poultry, Dairy, and Other Animal Products (contd.)

Meat products--Development of new or improved processes for the sausage industry; development of improved fermented dry pork sausage, and new lamb and mutton products; development of rapid analyses for process and product control; improved color and flavor stability and improved texture of meat and meat products; control of microbial contamination of meat and meat products; chemical evaluation of potential health hazards resulting from curing meat products.

Hides and leather--Improvement of leather yield and quality through determination of causes and control of damage to hides and skins; chemical modification of leather to improve its launderability, perspiration resistance, color-fastness, scuff-resistance, and self-polishing properties; improved technology of leather manufacturing, including continuous processing and development of instrumentation for process control; development of technology for comminuting cattlehide and dispersing the collagen; expanded use of collagen in foods, feeds, and industrial products.

VI FINANCIAL INFORMATION

The F.Y. 1970 Obligations and F.Y. 1971 Estimated domestic utilization research and development funds under "Salaries and Expenses, Agricultural Research Service," including allotments from the Special Fund for additional labor, are as follows:

| | F.Y. 1970 Obligations | F.Y. 1971 Estimated |
|---|---|---|
| Cereal and forage crops..... | $ 7,902,564 | $ 8,527,900 |
| Cotton, wool, and other fibers.. | 6,860,136 | 7,544,600 |
| Fruits and vegetables..... | 5,899,693 | 6,105,500 |
| Oilseeds..... | 4,667,630 | 4,898,000 |
| New and special plants..... | 3,510,458 | 3,390,300 |
| Poultry, dairy, and other animal products..... | 7,438,247 | 8,073,200 |
| Total, Utilization Research and Development..... | $36,278,728 a/ | $38,539,500 b/ |

a/ Includes portion of funds transferred from "Food and Nutrition Service" to meet unabsorbed pay costs pursuant to Public Law 91-231.

b/ Includes $1,635,100 proposed supplement to meet the 1971 increased pay costs authorized by Executive Order 11524 issued pursuant to the Federal Employees Salary Act of 1970 (P.L. 91-231) and wage board costs. Also includes a reduction of $13,100 for "Public Relations Activities." This $13,100 was made available to meet partial costs of pay increases for 1971.

In addition to the 1970 total shown above, $75,440 was obligated under non-recurring allocation from the Contingency Research Fund for purchase of unitized tandem gas chromatographic mass-spectrometric equipment for the analysis of nitrosamines and their potential precursors in meat products, and $78,344 for purchase of pilot-plant equipment for processing rice straw to improve its digestibility as animal feed, as a means of eliminating air pollution associated with its present method of disposal by burning.

Supplemental Information

(A) In addition to the domestic program, the equivalent of approximately $476,200 in foreign currencies was obligated in Fiscal Year 1970 for utilization research projects (largely extending over a five-year period) conducted under agreements with foreign institutions. This work is financed by funds generated under the P.L. 480 program.

(B) The Fiscal Year 1971 Appropriation Act provides increases for staffing and equipping newly-completed research laboratory facilities as follows:

| | |
|---|---|
| Albany, California | |
| Cereal and forage crops | $ 110,000 |
| Athens, Georgia | |
| Cereal and forage crops | 330,000 |
| Oilseeds | 90,000 |
| Poultry, dairy, and other animal products | 185,000 |
| Subtotal | 605,000 |
| Peoria, Illinois | |
| Cereal and forage crops | 180,000 |
| New Orleans, Louisiana | |
| Cotton, wool, and other fibers | 110,000 |
| Wyndmoor, Pennsylvania | |
| Poultry, dairy, and other animal products | 165,000 |
| Total increases | $1,170,000 |

# VII SELECTED RESEARCH ACCOMPLISHMENTS

Examples of the current program of utilization research were given in Section V of this report. In the present section are presented 21 selected examples of recent accomplishment under this program. For the most part, these examples concern research that has proceeded through the applied and developmental stages to the point of commercial acceptance of the processes or products involved. The accomplishments are illustrated on the facing pages.

## Starch-filled powdered rubber

Department scientists have developed starch-filled powdered rubbers which, like powdered plastics, can be molded or extruded without prior high-shear milling to give high-quality finished products. Industry estimates that use of powdered rubber would reduce processing costs at least 2-1/2 cents per pound of finished rubber goods by eliminating much of the heavy-duty equipment and power needed to incorporate curing and reinforcing agents, fillers, and other additives into slab rubber. In the new technology, powdered rubber is merely blended with the other ingredients and final mixing takes place during molding or extrusion. Without the addition of our starch products, rubber cannot be produced in powdered form except by costly means such as grinding in the frozen state. Currently, mechanical rubber goods, footwear, and miscellaneous types of molded rubber articles constitute a 3.4-billion-pound-per-year market in the United States. Use of starch-filled powdered rubbers in only half of this market would consume approximately 250 million pounds of starch and save over $40 million per year in processing costs.

# UTILIZING STARCH IN RUBBER PROCESSING

## Starch-Filled Powdered Rubber...

- REPLACES COSTLY SLAB RUBBER PROCESSING IN MANY USES
- MIXES EASILY WITH OTHER INGREDIENTS
- REDUCES EQUIPMENT COST 50%
- REDUCES PRODUCTION TIME
- PRODUCES HIGH QUALITY PRODUCT

**Potential Starch Use 250 MIL. LBS. PER ANNUM**

**...Yearly Saving $40,000,000**

Food applications expand markets for microbial gums

Food and Drug Administration approval for use of "xanthan" gum, a microbial polysaccharide produced from corn sugar, in human foods opens a large new market that is being rapidly exploited by industry. This product of Department research has been widely acclaimed in superlative terms by commercial developers for its unique combination of properties in aqueous systems. Effective in low concentrations, it forms stable suspensions of solids and oils; it makes thick solutions or gels, which flow when sheared; and it imparts excellent "mouthfeel" and flavor release to foods and drinks. Outstandingly significant is the lack of change in these properties by heat or cold, freezing and thawing, acids, or brines.

Xanthan gum is partially replacing expensive imported plant gums in the food market and extending into new use areas heretofore unfilled. It is expected to be a favored ingredient in food products such as oil dressings that pour equally well cold or hot; dry sauce and gravy mixes for meats that are stable when heat-sterilized, frozen, and thawed, or held on steam tables; an inexpensive, low-calorie instant pudding mix made without egg yolks or fat; and high-viscosity products that must flow easily when pumped.

Xanthan gum was discovered by Department scientists in a program designed to find new-type polysaccharides that are produced from corn sugar by microorganisms. Its commercial development represents an entirely new type of industry in the United States. Other microbial polysaccharides, discovered by Department scientistsand having distinctive properties also are under industrial evaluation of their use in the food and other industries.

# TEMPERATURE TOLERANT FOOD THICKENER

Excellent Texture and Flavor Release

Microbial Polysaccharide Processing . . . New Type of Industry

Xanthan Gum Has Stable Properties for Performance Either Hot or Cold

Economical Domestic Corn-Based Product Replaces Costly Imported Plant Gums

New high-yielding source of L-asparaginase

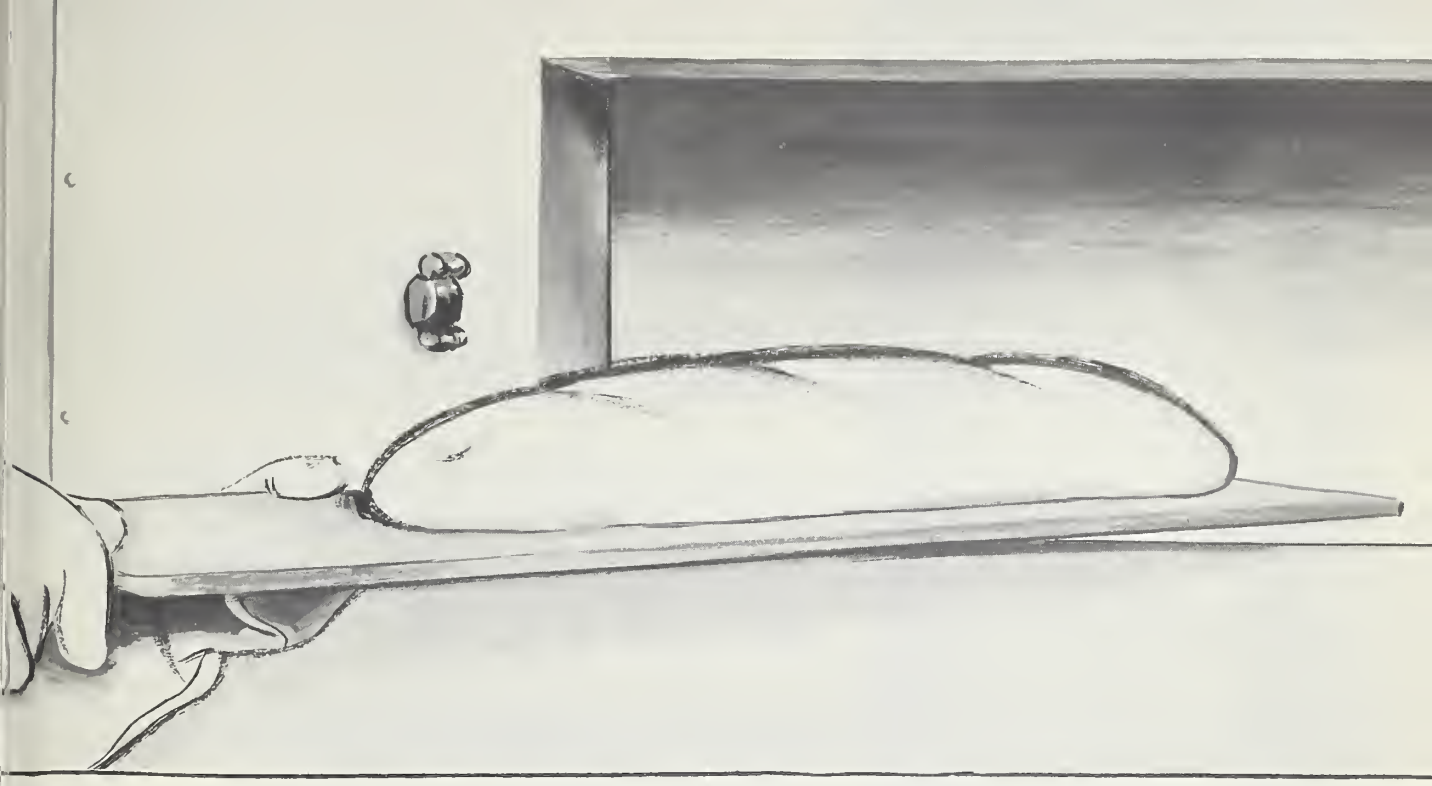
Survey of microorganisms in the Culture Collection at the Department's Northern Laboratory in Peoria has led to the discovery of a microorganism, Erwinia aroideae, which produces six times more L-asparaginase than has been reported from other sources. Besides giving high yields of L-asparaginase, E. aroideae is also superior to other sources of the enzyme because it produces only one type of L-asparaginase and not other forms of the enzyme. Recently, L-asparaginase was shown by workers elsewhere to be remarkably effective against one form of cancer, leukemia, in experimental animals. Animal tests indicate that the new enzyme source is effective in reducing leukemia in experimental animals. Recently, the National Cancer Institute requested quantities for tests with primates. Application for a public-held patent has been made.

# CULTURE COLLECTION YIELDS SUPERIOR SOURCE OF CANCER INHIBITOR

- Six Times More L-Asparaginase Produced Than From Other Sources
- May Aid Leukemia Patients Allergic To Present Agent

Sour dough French bread secrets revealed

Delectable, highly-prized San Francisco sour dough French bread is shipped daily on the nation's airlines to fine shops and restaurants throughout the United States. In recent studies, Department scientists have isolated and identified the heretofore elusive yeast and bacteria that make this unique local bread possible. The yeast is distinguished by its tolerance of acetic acid and its inability to ferment maltose (malt sugar). The bacterium, previously undescribed, produces acetic acid and will not grow without maltose. Other unusual nutrient and growth characteristics help to explain why previous attempts to use San Francisco starter doughs elsewhere have been unsuccessful. Conditions were found that permit holding the starter doughs as long as five days, rather than the traditional 8 to 10 hours. This breakthrough has several implications, from broadening the base of manufacture of sour dough breads to a national level, to a means of imparting good flavor characteristics in new short-term fermentation products that would otherwise be dull and unattractive. This work promises to greatly enhance the use of wheat on a nation-wide scale.



# SOUR DOUGH BREAD BAKING - BREAKTHROUGH

## Unique Yeast-Bacteria Complex Found in Dough . .

PERMITS USE OF PURE CULTURE METHOD

MAKES PROCESSING FASTER AND CHEAPER

COULD ADD FLAVOR TO MODERN BREADS

New technology for durable-press cotton adopted by industry

Rapid commercialization of four recent Department research achievements is helping cotton to retain or expand its share of an important market: 2.6 billion square yards of fabric treated annually for durable-press applications.

The first is an addition to the highly successful family of carbamate agents previously introduced through Department research. Since the new compound, dimethylol isopropyl carbamate, can be applied much more easily than earlier carbamates, the resulting fabrics consistently have optimum durable-press properties, such as durability of finish and resistance to yellowing.

Another research result--the incorporation into the crosslinking compound of transient groups that increase reactivity--has circumvented the expensive relationship that usually exists between difficulty of application and durability. A finishing agent that reacts with cellulose slowly at high temperature produces a very durable finish but adds to the cost of processing. By increasing the reactivity of the agent in this way, it is possible to provide durability at low curing temperature and thus at reduced cost--a combination enthusiastically adopted by industry. Each of these improved agents can be combined with either of two other recent research developments to further improve the competitive position of durable-press cotton. To reduce production costs, an active catalyst mixture has been devised to decrease the temperature at which a crosslinking agent must be cured or to shorten the time required at any given temperature. And, finally, additives have been developed to increase the moisture absorptivity--and thus the comfort--of the finished cotton; these are important properties to the consumer in selecting this natural fiber rather than a synthetic.

# BETTER DURABLE-PRESS COTTON ATTRACTS INDUSTRY

- New Agent Gives Durable Finish and Resists Yellowing
- Crosslinking Method Reduces Manufacturing Cost
- Additives Shorten Curing time and Increase Comfort of Finished Product

**RESEARCH HELPS 100% COTTON COMPETE IN TREATED FABRIC MARKET**
**2.6 Bil. Sq. Yds. Annually**

Efficient utilization of discount cottons

Department scientists are now solving a major problem that involves about 25 percent of the cotton crop: how to increase utilization of discount cotton, which includes not only short-staple cottons, but also very fine and very coarse cottons. This cotton often sells at a discount of several cents a pound; most mills in the United States prefer not to use it because it is difficult to process or cannot be used in quality fabrics. The resultant higher manufacturing costs more than offset the lower cost of the raw cotton.

Through in-house and contract research, techniques have been developed for homogeneously blending cotton that differs widely in fineness, and for efficiently processing the resulting blends. In most cases, yarns spun from discount cotton were equivalent in quality to those spun from cotton having average fineness. These yarns were adequate for use in many consumer products. In sheeting, for example, bleached fabrics had acceptable market quality, and dyed fabrics were acceptable for some markets. By expanding demand for discount cotton in the United States, this research will reduce government loan costs, textile manufacturing costs, and consumer costs for a variety of end-products. In addition to domestic use, discount cotton has potential in important export markets; indeed, organizations in the major textile-producing countries are enthusiastically evaluating commercial application of the new technology.

# INCREASED UTILIZATION OF DISCOUNT COTTON

## Blending Cotton Through Conventional Equipment for Good Quality Products at Low Cost. . . Benefits Manufacturer and Consumer

***EXPORT MARKET POTENTIAL***

Better blends of natural fibers (wool, mohair, and cotton)

Procedures for optimal manufacture of interblends of the nautral fibers (wool, mohair, and cotton) will result from a Department contract study recently completed at Texas Technological University. Blends of the natural fibers offer features that so far have not fully exploited. Wool provides textiles with such subjective properties as excellent "hand" and "drape". Mohair provides desirable luster and bounciness in fabrics. Cotton offers softness at a low price. All three natural fibers offer comfort in wear. Through judicious blending, textile fabrics can be obtained that can widen market opportunities for the three natural fibers. For example, superior durable-press and tropical-weight fabrics open the way for greater year-round use in many apparels. The Texas Technological blend study was carried out with conventional cotton processing equipment. It was found that blending done early in the manufacturing sequence is most advantageous with respect to uniformity and quality of the yarn produced. Wool alone cannot be satisfactorily processed on the cotton system equipment, but when blending is done at the first, "raw stock", stage, it is handled with ease. No significant changes are required in the conventional cotton processing method if the natural fibers are reasonably matched in length and fineness.

# INCREASING MARKET FOR NATURAL FIBER BLENDS

## Early Blending by Conventional Equipment Produces Fabric for "Year-round" Use

**WOOL..**
DRAPE
and
BODY

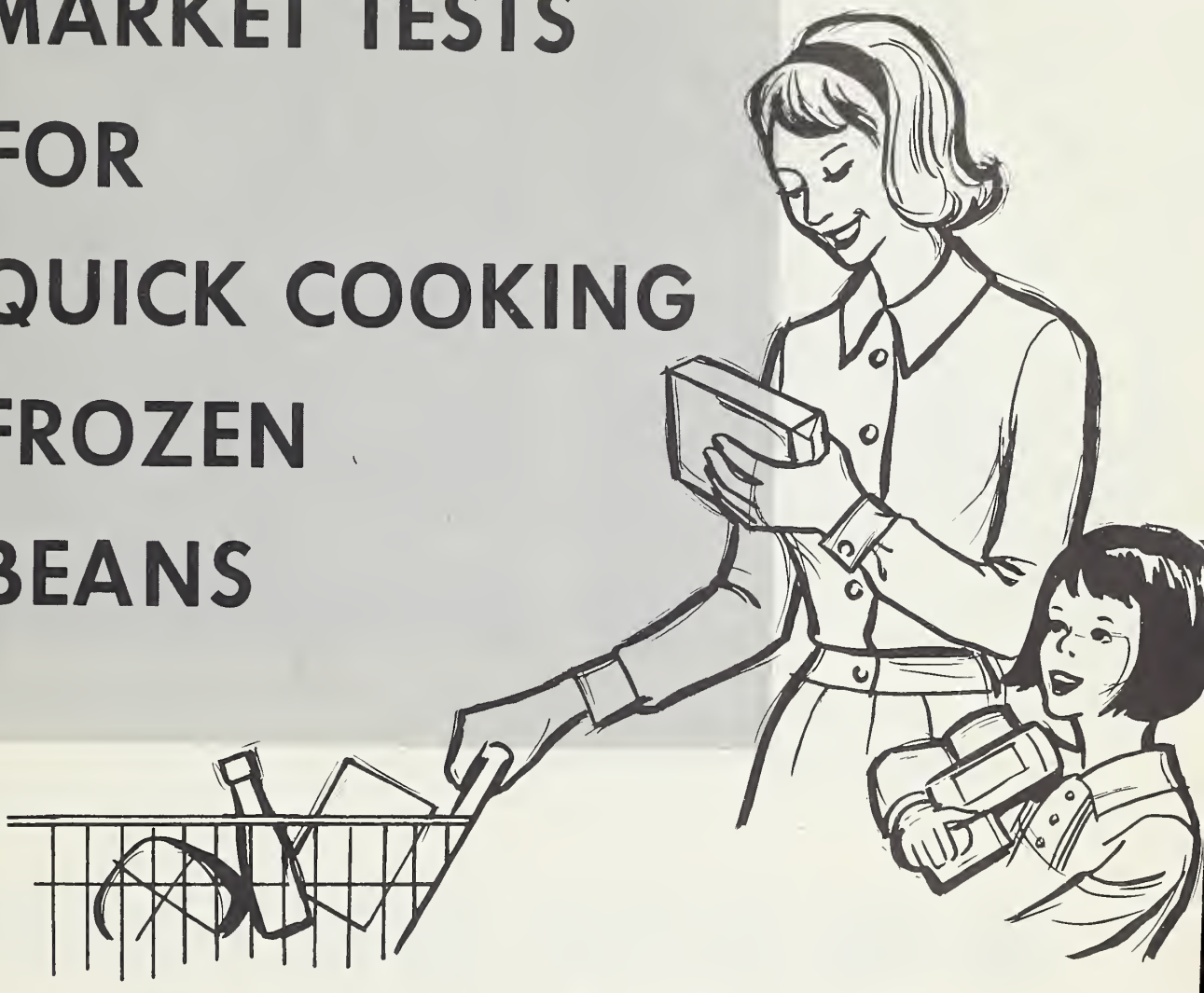
**COTTON..**
SOFTNESS and
LOW COST

**MOHAIR..**
LUSTER and
BOUNCE

Frozen dried bean products

A total of about 240,000 pounds of frozen, hydrated quick-cooking beans have been produced by a California cooperative utilizing a new USDA process. About 200,000 pounds of the frozen beans have been shipped to Alabama for extensive market tests in at least four marketing areas of the Southeastern states. In some areas three or more re-orders have been obtained, indicating continued use or wider acceptance of these new high-protein foods. Frozen, quick-cooking large Lima, blackeye, and baby Lima beans appear to be the most widely accepted; however, kidney, small white, and pinto beans also have been well received. Additional market tests are being scheduled on the West Coast. For this test, frozen, quick-cooking large Lima beans will be prepared from dry beans.

# MARKET TESTS FOR QUICK COOKING FROZEN BEANS

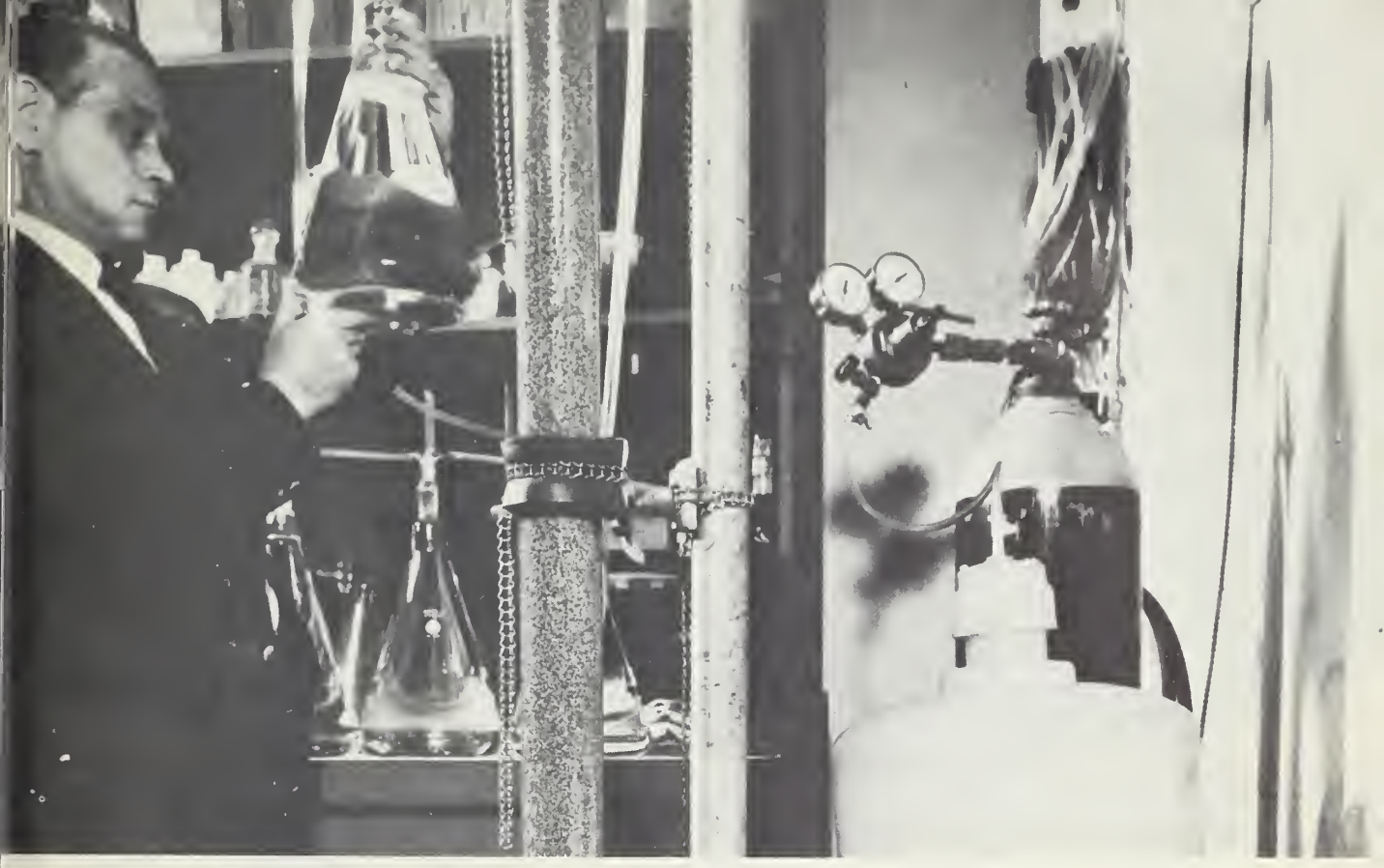


## Evaluation of Market Tests Proves...

- WIDE CONSUMER ACCEPTANCE
- GOOD REPURCHASE PATTERN
- EXCELLENT FLAVOR AND TEXTURE

Olive brine reclamation to reduce pollution

A Department-developed process has been tested at plant scale to reduce by half the salt and other polluting substances in waste waters from olive processing and storing plants. Used storage brines were renovated by activated carbon treatment to remove objectionable organic materials. Newly-harvested olives were stored in freshly renovated brines and in brines that had been held several weeks after renovation. No adverse effects on quality of processed olives occurred, although changes in odor and appearance occurred in the stored renovated brines. After laboratory studies, Department scientists and engineers designed the plant scale equipment and provided consultative support to the National Canners Association (NCA), which conducted the large-scale tests with funding from the olive industry and the Federal Water Quality Administration. NCA estimates that by utilizing industry cooperative efforts, brine renovation could be operated at a cost as low as $1.67 per year per ton of olives processed.



COOPERATIVE FEDERAL/INDUSTRY PLANT SCALE
TESTS DEMONSTRATE USDA PROCESS

# RENOVATED OLIVE BRINE CUTS PROCESSING POLLUTION 50%

- Olives Unaffected by Brine
- Low Cost Reclamation Process Developed

Reduction of air pollution from citrus feed mills

Converting citrus waste to dried feed and citrus molasses provides necessary and profitable disposal of this material, which is equal in weight to 40 percent of the fruit processed. But air pollution from particulate matter in the stack gases discharged has become a major problem. By demonstrating different ways to adequately regulate emissions, results of a USDA contract study will permit plants of all sizes to achieve control at a cost they can absorb--a major contribution to reducing pollution from this source.

To develop methods of control, the scientists conducted tests at three citrus feed mills of different design. The two plants that had both a feed drier to recirculate air and a waste heat evaporator were well below the tolerance for air pollution. The third, which had only an air scrubber on exhaust gases, was at first over the tolerance, but it has been remodeled and is now expected to be within permissible limits. Information on costs in relation to drier efficiency also is being obtained. The large recirculating waste heat evaporators are expensive but could be easily amortized by major mills. However, the smaller driers with spray scrubbers would be more suitable for other concerns.

# CITRUS DRIERS GET AIR POLLUTION CHECK-UP

Tolerance Tests at Citrus Feed Mills Have Established Procedures and Equipment Recommendations for Reducing Pollutants in Stack Gases

***USDA STUDY MAKES ECONOMICAL AIR POLLUTION CONTROL POSSIBLE FOR PLANTS OF ALL SIZES***

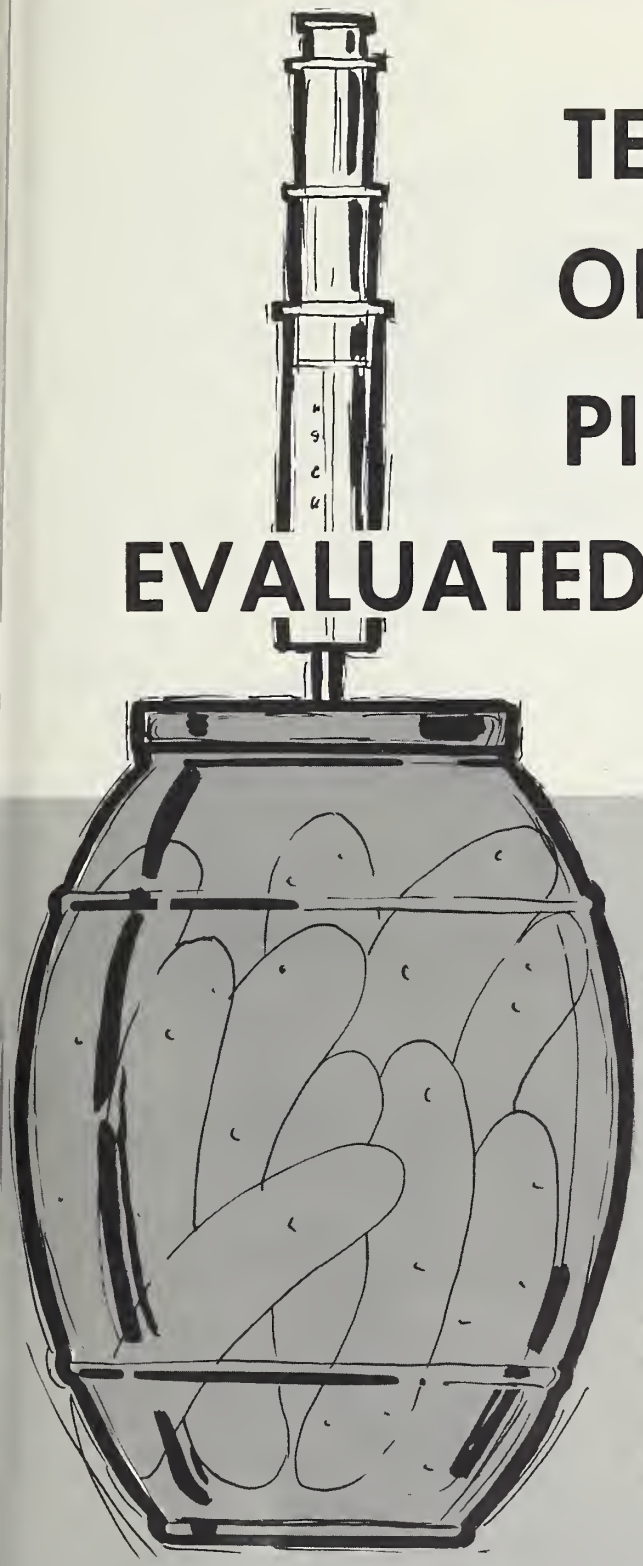
Test packs of pure-culture fermented pickles evaluated by industry

Pure culture fermentation has been called the first breakthrough in the basic process for pickling cucumbers and other vegetables in more than 4,000 years of pickle history. Eight companies, including several giants of the food processing industry, have put up test packs of pure culture pickles in institutional-sized containers, or plan to do so this season. Industrial representatives have scheduled a short course to teach other pickle packers how to apply the new procedure commercially.

Pure culture fermentation enables the industry to improve quality, offer new products, and reduce costs. Other advantages include control of bloaters and other defects in brine-stock pickles, better sanitation, and fewer disposal problems with salt and acid wastes. Most important, however, is that flavor characteristics of the final product can be tailored by selecting the type of cucumber and lactic acid bacteria.

In the age-old method of pickling in vats, fermentation depends on lactic acid bacteria that enter the brine solution by chance. However, in the controlled process developed by the USDA in cooperation with the North Carolina and Michigan Agricultural Experiment Stations and Pickle Packers International, Inc., the undesirable and interfering naturally-occurring microorganisms are inactivated. The cucumbers are washed, heat treated, packed in containers, seasoned with spices, and then covered with a pasteurized acidified salt brine. Each container is inoculated with the bacteria culture desired and then sealed. In contrast to the lengthy conventional method, the new pickling process is complete within a week, although flavor continues to develop for a longer period. The method can also be applied to carrots, string beans, okra, and other vegetables, and to Spanish-type fermented green olives.

# TEST PACKS OF PURE CULTURE PICKLES EVALUATED BY INDUSTRY

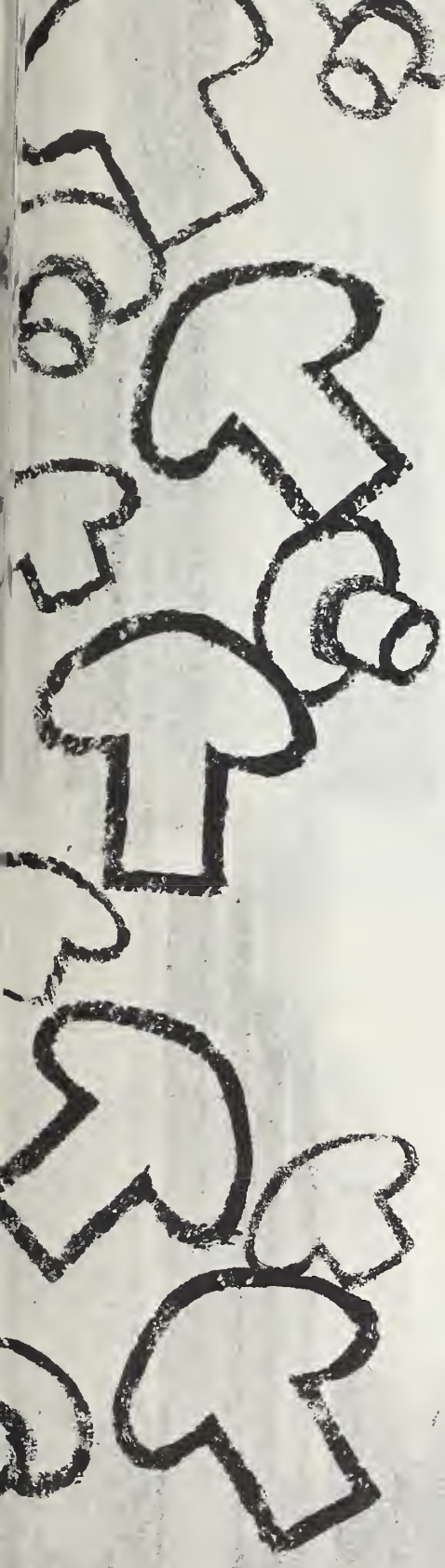


- Processing Time Reduced
- Cost Reduced
- Waste Disposal Reduced
- Pollution Reduced
- Quality Improved
- Flavor Characteristics Tailored as Desired

***METHOD ADAPTABLE TO OTHER VEGETABLES***

Air-dried mushrooms

A new process for hot-air drying of cultivated mushrooms was developed by Department scientists in order to increase consumption of domestic mushrooms. This will help to relieve the economic pressures imposed on American mushroom growers by the increasing influx of imported processed mushrooms. The process yields a product similar in flavor to the very expensive freeze-dried mushrooms at about half the cost. The product is stable in sealed containers. Blanching, which was necessary in the previous process, is not required to inhibit enzyme action and the dried mushrooms have an attractive light color. A large mushroom canner now dries cultivated mushrooms by this process and suppiies them for use in commercial food operations.



NEW DRYING PROCESS

# PROMOTES MARKET FOR DOMESTIC MUSHROOMS

Retains Flavor
and Color - Similar
to Freeze-Dried
Product
at Half the Cost

HELPS GROWERS AND PACKERS
MEET IMPORTED COMPETITION

Better product and less waste in tomato processing

Department scientists and engineers have found that removing natural wax from the skins of fruits and vegetables before lye peeling contributes to better quality, improved yield, lower cost, and less waste. The new process permits successful application of lye peeling to certain soft vegetables and to many fruits that previously could not be peeled effectively in this way. A hot organic solvent is used in the new process to remove the wax layer that causes resistance to lye treatment, and formerly required so much heat treatment for lye penetration that damage to quality or excessive loss of product resulted.

The process has already been adopted by a tomato packer for lye-resistant mechanically harvested tomatoes. In the first season of use the yield of premium-pack tomatoes was increased by 17.5 percent, waste disposal was reduced by 40 percent, lye costs were lowered by 67 percent, and the overall quality of the product was improved. It is estimated that the use of this process returned $870,000 to the packer after deducting equipment costs, and benefited the consumer by providing higher quality products. Other canning companies will use the process.

# DEWAXING IMPROVES TOMATO PROCESSING

## Commercial Testing of New Process Shows. . .

- LYE COST REDUCED 67%
- WASTE DISPOSAL REDUCED 40%
- YIELD INCREASED 17½%

*CONSUMERS BENEFIT BY HIGH QUALITY PRODUCT*

Valuable citrus peel oil and essence recovered from processing waste

Few research developments provide triple benefits: recovering valuable new products from waste, abating the pollution problems that would result from their disposal, and providing materials needed to improve the properties of existing products. But Department scientists have developed a technique that promises to do all three. Volatile water-soluble essences and distilled oil are recovered from citrus peel slurries, extracts, and juice components, which comprise one of the effluents of citrus processing plants. These essences and oil greatly enhance the flavor of frozen, canned, instant, and other citrus products, imparting to them the flavor of fresh fruit.

Industrial interest is high, and at least two companies are already evaluating the process. Orange essence from juice is a premium product--$6 to $10 a gallon, 100-fold -- but the amount of this essence needed to improve the taste of instant juice is greater than that available from an equivalent amount of fresh juice. However, the essence from one volume of waste would be enough for five to ten volumes of juice. In addition, by decreasing the potency of the desludger effluent by 25 to 35 percent, commercial application of this process will reduce dispoal problems and potential stream pollution.

# VALUABLE PRODUCTS FROM CITRUS WASTES

## Recovery Method Provides Triple Benefits

1. YIELDS NEW PRODUCTS . . CITRUS PEEL OIL AND AROMA SOLUTIONS

2. IMPROVES FLAVOR OF EXISTING PRODUCT

3. LESS WASTE FOR DISPOSAL . . REDUCES POLLUTION

*METHOD UNDER INDUSTRY EVALUATION*

Linseed oil for curing and protecting concrete

Department scientists have developed a linseed oil emulsion which, when applied to freshly laid concrete, permits the concrete to retain sufficient water for normal curing and, at the same time, protects the concrete from subsequent deterioration in winter on exposure to freeze-thaw cycles and de-icing chemicals. This emulsion has been used successfully on a commercial scale for curing and protecting concrete in Kansas, Oklahoma, and Texas. Four companies are now manufacturing this emulsion.

When concrete is laid, it is necessary to cover the surface to retain the moisture needed for proper curing; this protection is needed for about 14 days. One of the covering agents used has been a spray-on coating. Previous work had shown that linseed oil coatings were effective in protecting concrete from winter damage, particularly when salt was used; the oil could be applied over the spray-on curing coating. The oil was usually applied a month after the concrete was placed, and it resulted in added expense to the contractor. Department scientists found that linseed oil could be used to give the surface protection needed during curing. Curing and protecting concrete with linseed oil emulsions is likely to result in the use of oil on new highways as well as specialized structures, and should increase the consumption of linseed oil. Improved emulsions that perform better as curing agents may greatly extend the use of linseed oil for this purpose. Flaxseed from which linseed oil is obtained is an important crop in the States of Minnesota, North Dakota, South Dakota, and Texas.

# LINSEED OIL COVER FOR NEW CONCRETE

## New Method of Direct Application to Freshly Laid Concrete

- REDUCES HIGHWAY CONSTRUCTION COST
- RETAINS MOISTURE FOR NORMAL CURING
- PROTECTS CONCRETE FROM THE ELEMENTS
- NOW IN COMMERCIAL USE IN THREE STATES

**INCREASED USE OF LINSEED OIL VITAL TO FLAXSEED PRODUCING STATES**

Commercially useful naval stores products from ponderosa pine stumps

Transformation of millions of tons of ponderosa pine stumps into useful naval stores products may provide new jobs for many underprivileged persons, including Indians or Latin Americans. This achievement is the result of research conducted by Department scientists in cooperation with the Four-Corners Regional Economic Development Commissions of Arizona and New Mexico and a naval stores processor in Florida. Large quantities of the pine stumps are left from logging operations conducted in the southwestern states between 1909 and 1925. In Arizona and New Mexico alone, they represent a potential of over $40 million worth of products from a presently unused resource. Since the information derived in the research is applicable to similar stumps from other parts of the country, their profitable use will bring increased prosperity to many rural areas and to the naval stores industry.

A successful run in a naval stores processing plant was conducted on Arizona stump wood. The resultant products--rosin, pine oil, and turpentine--are somewhat different in composition from those obtained from southern pine stumps but could be modified to give comparable end products. The crude pine oil was fractionated on a pilot-plant scale to yield quality pine oil and significant amounts of high-grade longifolene, a potentially valuable chemical intermediate. In tests completed by a large paper company, paper size prepared from the rosin was successfully used in conventional industrial equipment for the manufacture of kraft products. Other rosin derivatives are being prepared for evaluation in commercial applications and markets.

## *ECONOMIC POTENTIAL FROM*

# PONDEROSA PINE STUMPS

***Resources Available for Over $40 million in Products***

**RESEARCH COULD LEAD TO**

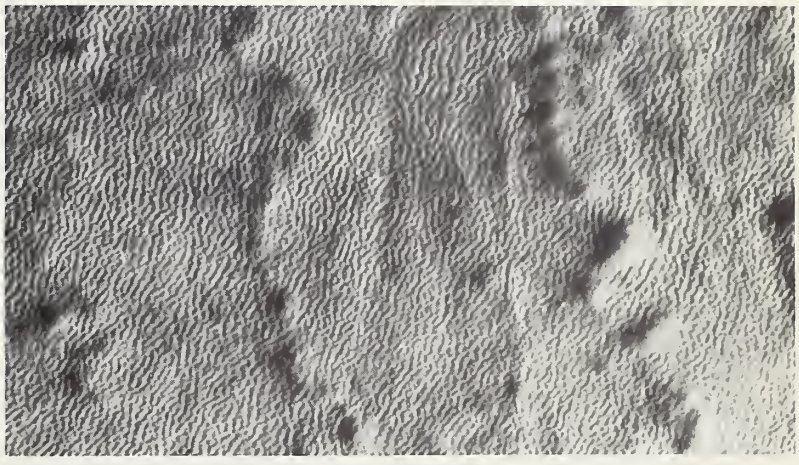
**Job Opportunities in Rural Development Areas by the Processing of Naval Stores Products from Salvaged Pine Stumps**

Improved sheepskin leather

Cockle, a seasonal sheepskin defect, has been shown by Department workers to be caused by the common ked, Melophagus ovinus, a blood-sucking parasite. Based on data collected over the last two years, at least a fourth of the 10 million sheep and lambs slaughtered annually are affected by keds. Cockle is estimated to cause annual losses of at least $4 million to this segment of our leather industry, resulting in products of inferior quality that invite replacement by substitutes and undue competition from imported skins. For example, a sheepskin from an infected sheep yields garment suede leather that is worth on the average $1.68 less than the product derived from a noninfected animal. Keds also reduce the yields of wool and meat. Infected sheep produce wool of reduced staple length and weight. Dressed carcasses from infected sheep are worth on the average $1.64 less than the carcasses from noninfected animals. At a cost of 50 cents per animal, sheep can be dipped in a suitable insecticide to eliminate keds, resulting in an overall increase in skin and carcass value of about $3.76. This economic benefit provides an important contribution to current efforts directed toward revitalization of the sheep industry.

# KED CONTROL *ELIMINATES* COCKLE DEFECT

## *IN SHEEPSKINS*



## Treating Sheep to Eradicate Parasite

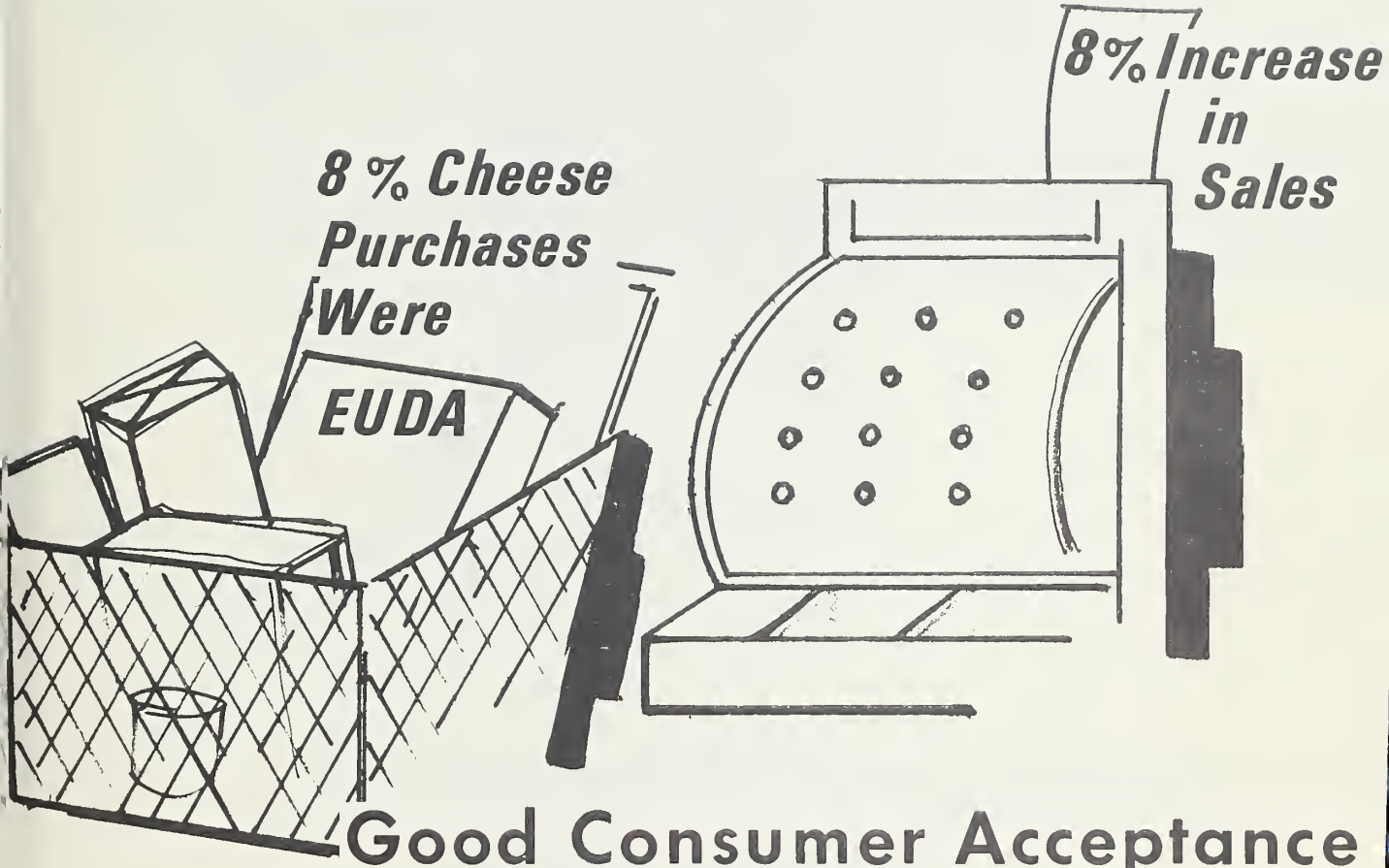
### *Worth $4 Million Yearly to Leather Industry*

New low-fat cheese developed

A new skim milk semisoft cheese with low fat content has been developed by Department scientists. The cheese has been made on a pilot plant scale at USDA's Beltsville laboratories and has been test-marketed. Consumers liked the new product, called "EUDA" cheese because it was developed by the Department's Eastern Utilization R&D Division. Their purchases of EUDA in a twelve-week period amounted to about eight percent of all other cheese varieties in the survey, while not significantly affecting the sales of other varieties. This development has stimulated considerable public and commercial interest in low-fat cheese, and over a hundred cheese manufacturers and food processors have received manufacturing instructions for making it. A well known cheese company has requested licensing under a Government patent issued to cover the production of EUDA cheese, and has indicated its intention to manufacture and sell this product in interstate commerce. Several other commercial firms are now producing their own versions of a low-fat cheese, relying heavily on USDA research results for their development.

# FLAVORFUL LOW FAT CHEESE

## *EUDA Market Test Findings...*




Good Consumer Acceptance

75% of Buyers Planned to Repurchase

DEVELOPMENT HAS LED TO COMMERCIAL PRODUCTION

Enrichment of whole milk with iron

Iron and calcium are nutrients most often found to be below recommended daily allowances in the diets of several population groups. In a large number of children under three years of age, daily iron intake is estimated to be 50 percent below recommended amounts. Enrichment of milk with iron could be a major means of correcting iron deficiency in the diet. Department scientists have now established, and can recommend to dairies, suitable procedures for incorporating 10 milligrams of iron per quart of whole milk. This level is appropriate for improvement of nutritional quality when used by iron-deficient population groups. Changes in processing are necessary to avoid off-flavors when iron is added to milk, but these changes can be readily instituted by dairies. More widespread acceptance and use of iron-fortified milk should result in improving the nutrition, and hence the health and well-being, of deficient individuals and groups.

# WHOLE MILK
# PLUS IRON

- Improves Nutritional Quality of Milk Essential to Diet DeficientGroups

- Processing Method Allows for Addition of Iron With No Off Flavor

Market potential established for dried whole milk

Prospects for the commercial success of beverage-quality vacuum foam-dried whole milk developed by Department engineers were increased by the results from market testing of the product, by the Economic Research Service, in nine supermarkets in Philadelphia suburbs. The product was priced at 4 cents less per quart than fresh whole milk sold in half-gallon containers, out of the same refrigerated dairy case. Cost estimates indicate that this price differential is feasible when the dry product is prepared from milk of manufacturing grade.

In a 12-week period, approximately 280 cases of 24 quart-equivalent packages were sold--a very high rate of average sale per store for a new item. A substantial number of the purchases were made to supplement the customers' fresh milk supply rather than to replace it, indicating high consumer acceptance. Most users who were interviewed made very favorable comments about its taste, ease of storage, and reconstitution. Another indication of the strong acceptance of the product was provided by the repurchase pattern. More than three-fourths of the users said that they planned to repurchase the product, and two weeks later more than a third had actually repurchased it. The product has a shelf life of more than a year when refrigerated, and presents no problems to the retailer.

## Market Testing in 9 Food Stores Proves Consumer Acceptance...

►FLAVOR APPEAL ►STORAGE EASE

►SUPPLEMENTS FRESH MILK SUPPLY

...GOOD REPURCHASE PATTERN

***SHELF-LIFE OF REFRIGERATED PRODUCTS - OVER 1 YEAR***

New method for improving the color and odor stability of commercial fatty acids

Commercially available fatty acids, particularly those made from such natural products as beef tallow and soybean oil soap stock, have poor color and odor stability as shown by a tendency to develop an objectionable odor and dark color during heating or reaction with other chemicals. For this reason their use is limited in such products as foods, toiletries, and protective coatings. A new procedure has been devised under a USDA grant project for obtaining industrial fatty acids that have better color and odor stability than the current products. In this new procedure, a solution of the crude fatty acid mixture obtained from processing of natural products is passed through a column containing silica gel, a solid substance that selectively absorbs impurities. The fatty acids eluted from the column have a superior color stability and less odor, and do not require further purification. Further, the column material can be regenerated and re-used. Current American production of commercial fatty acids is approximately 500 million pounds a year; this can be expected to increase greatly if the new method is widely adopted by industry. One company plans to utilize this process for upgrading selected fatty acid products now being manufactured. This firm has also indicated an intent to obtain a license under a public service patent for which the Department has applied.

# EXPANDING USES FOR IMPROVED FATTY ACIDS

## *FROM ANIMAL PRODUCTS*

New Process
Removes
Impurities . . . ▶

Giving a
Product . . . ▶

Suitable for
Use in . . .

- Foods
- Toiletries
- Protective Coatings

**INDUSTRY ADOPTION WOULD INCREASE**
**500 MILLION POUND YEARLY MARKET**